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10/24/03
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DECLARATION OF ZHEFEI J. CHEN

Sir:

I, Zhefei J. Chen, declare under the penalty of perjury as set forth below.

1. I am a joint inventor with Robert J. Small named in the above-identified patent application ("Application") and an employee of EKC Technology, Inc., the assignee ("Assignee") of the Application. I have worked for the Assignee from **February 1995** until **May 2000**, and held the position of **Sr. Research Chemist**.

2. As part of our work for EKC, Robert J. Small and I developed compositions for polishing a substrate having a noble metal material, or a material comprising a noble metal, on its surface. The compositions comprised periodic acid, or H_5IO_6 , which we often referred to as "PIA" and which is referred to hereinafter as PIA, and an abrasive.

3. In certain embodiments, these components were present in the compositions in a combined amount to render the substrate surface substantially planar upon chemical-mechanical polishing of the substrate surface.

4. In certain embodiments, the periodic acid and the abrasive were present in the compositions in an amount from about 0.05 to about 0.3 moles/kilogram and from about 0.2 to about 6 weight percent, respectively.

5. The subject matter set forth above in items 2, 3 and 4 were conceived and reduced to practice before December 17, 1999.

6. Pending claims 1-18 of the Application, as reflected in Document C appended hereto, relate to the subject matter set forth above in items 2 and 3, the reduction to

practice of which is described below in relation to the subject matter of claim 1 and various claims depending therefrom.

7. Pending claims 19-31, 33-35 and 76 of the Application, as reflected in an Appendix hereto, relate to the subject matter set forth above in items 2 and 4, the reduction to practice of which is described below in relation to the subject matter of claim 19 and various claims depending therefrom.

8. Document A, appended hereto, shows a table of results (unnecessary portions of which have been redacted) from the chemical-mechanical polishing of wafers, each wafer having a noble metal material, Iridium (Ir), on its surface. The chemical-mechanical polishing was carried out using a composition comprising an abrasive, the commercial alumina abrasive product "CR-30" manufactured by Baikowski Chimie Co. of Annecy Cedex 9, France (see specification pages 4 and 7, for example), identified in the table and hereinafter as "CR30," in an amount of 2 weight percent, identified in the table as "wt%," and PIA, identified in the table as "Ox5," in an amount of 0.1 mol/kilogram, identified in the table as "mol/Kg." Such a composition showing a removal rate for Iridium of 288 Angstroms per minute, identified in the table as "A/min," corresponds to Composition A of the Application (see specification pages 6-8). In a particular case, the composition also comprised tetramethylammonium hydroxide, identified in the table as "Base 2." Such a composition showing a removal rate for Iridium of 324 Angstroms per minute corresponds to Composition B of the Application (see specification pages 8-10). The table of results shown in Document A was prepared before December 17, 1999.

9. Document B, appended hereto, shows a table of results (unnecessary portions of which have been redacted, and the layout of which has been altered to fit on one page) from the chemical-mechanical polishing of wafers, each wafer having a noble metal material, Iridium (Ir), on its surface. The chemical-mechanical polishing was carried out using compositions comprising an abrasive, CR30, and either a "ZCX206" component or a "ZCX206a" component. We used "ZCX206" to refer to a combination of PIA and ammonium hydroxide (NH_4OH), the latter to bring the pH of the composition to about 7. Such a composition corresponds to Composition C of the Application (see specification pages 10-12). We used "ZCX206a" to refer to a combination of PIA and ammonium hydroxide (NH_4OH), the latter to bring the pH of the composition to about 3. Such a composition corresponds to Composition D of the Application (see specification pages 12-14). The table of results shows wafer-within-wafer non-uniformity percentages, identified as "NU%," for the polished wafers. The table of results shown in Document B was prepared before December 17, 1999.

10. The tables shown in Document A and Document B were generated from chemical-mechanical polishing experiments implemented by myself with the assistance of scientists under my direct supervision before December 17, 1999.

11. The tables shown in Document A and Document B and similar information dated both before and after December 17, 1999 have been kept among the usual business records of the Assignee in the ordinary course of business.


12. In view of the foregoing, the invention as reflected in claim 1 of the Application, as well as at least claims 2-10 and 13-17 depending therefrom, was conceived and reduced to practice before December 17, 1999.

13. In view of the foregoing, the invention as reflected in claim 19 of the Application, as well as at least claims 20-26, 29-31, 34 and 76 depending therefrom, was conceived and reduced to practice before December 17, 1999.

14. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishment by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such wilful false statements may jeopardize the validity of the application or any patent issuing thereon.

Executed on the date set forth below at Hayward, California.

Oct. 1, 2003
Date


Zhefei J. Chen



Appendix: Pending Claims Under Consideration

1. A composition for polishing a substrate surface having at least one feature thereon comprising a noble metal, a noble metal alloy, a noble metal oxide, or any combination thereof, comprising:

periodic acid and an abrasive in a combined amount sufficient to render the substrate surface substantially planar upon chemical-mechanical polishing thereof.

2. The composition of claim 1, wherein periodic acid is in an amount from about 0.05 to about 0.3 moles/kilogram.

3. The composition of claim 1, wherein periodic acid is in an amount from about 0.075 to about 0.175 moles/kilogram.

4. The composition of claim 1, wherein the abrasive is in an amount from about 0.2 to about 6 weight percent.

5. The composition of claim 1, wherein the abrasive is in an amount from about 0.2 to about 4 weight percent.

6. The composition of claim 1, further comprising a pH-adjusting agent selected from a group consisting of a quaternary amine, an inorganic base, or any combination thereof.

7. The composition of claim 6, wherein the pH-adjusting agent comprises an agent selected from a group consisting of tetramethylammonium hydroxide, ammonium hydroxide, potassium hydroxide, sodium hydroxide, or any combination thereof.

8. The composition of claim 1, further comprising a pH-adjusting agent in an amount sufficient for a pH level of the composition to be in a range of from about pH 5 to about pH 10.

9. The composition of claim 1, further comprising a pH-adjusting agent in an amount sufficient for a pH level of the composition to be in a range from about pH 1 to about pH 4.

10. The composition of claim 1, further comprising a pH-adjusting agent in an amount sufficient for a pH level of the composition to be in a range from about pH 2 to about pH 3.

11. The composition of claim 1, further comprising a suspension agent.

12. The composition of claim 11, wherein the suspension agent comprises an agent is selected from a group consisting of an organic acid, a surfactant, another abrasive, and ethyl carbonate.

13. The composition of claim 1, wherein the abrasive comprises an abrasive having a Mohs hardness number of greater than about 6.5.

14. The composition of claim 1, wherein the abrasive comprises an abrasive selected from a group consisting of alumina, silica, zirconia, spinel, zirconium nitride, carbide, and any combination thereof.

15. The composition of any of claims 1 through 11, wherein the abrasive comprises alumina.

16. The composition of any of claims 1 through 11, wherein the feature comprises a material selected from a group consisting of Ir, IrO₂, Pt, and any combination thereof.

17. The composition of claim 1, wherein said combined amount is sufficient to provide the substrate surface with a WWNU of less than about 12%.

18. The composition of claim 1, wherein said combined amount is sufficient to provide the substrate surface with a WTWNU of less than about 5%.

19. A composition for polishing a substrate surface having at least one feature thereon comprising a noble metal, a noble metal alloy, a noble metal oxide, or any combination thereof, comprising:

periodic acid in an amount from about 0.05 to about 0.3 moles/kilogram; and
an abrasive in an amount from about 0.2 to about 6 weight percent.

20. The composition of claim 19, wherein the amount of periodic acid is from about 0.075 to about 0.175 moles/kilogram.

21. The composition of claim 19, wherein the amount of the abrasive is from about 0.2 to about 4 weight percent.

22. The composition of claim 19, further comprising a pH-adjusting agent selected from a group consisting of a quaternary amine, an inorganic base, or any combination thereof.

23. The composition of claim 22, wherein the pH-adjusting agent comprises an agent selected from a group consisting of tetramethylammonium hydroxide, ammonium hydroxide, potassium hydroxide, sodium hydroxide, or any combination thereof.

24. The composition of claim 19, further comprising a pH-adjusting agent in an amount sufficient for a pH level of the composition to be in a range of from about pH 5 to about pH 10.

25. The composition of claim 19, further comprising a pH-adjusting agent in an amount sufficient for a pH level of the composition to be in a range from about pH 1 to about pH 4.

26. The composition of claim 19, further comprising a pH-adjusting agent in an amount sufficient for a pH level of the composition to be in a range from about pH 2 to about pH 3.

27. The composition of claim 19, further comprising a suspension agent.

28. The composition of claim 27, wherein the suspension agent comprises an agent selected from a group consisting of an organic acid, a surfactant, another abrasive, and ethyl carbonate.

29. The composition of claim 19, wherein the abrasive comprises an abrasive having a Mohs hardness number of greater than about 6.5.

30. The composition of claim 19, wherein the abrasive comprises an abrasive selected from a group consisting of alumina, silica, zirconia, spinel, zirconium nitride, carbide, and any combination thereof.

31. The composition of any of claims 19 through 27, wherein the abrasive comprises alumina.

33. The composition of claim 19, wherein said composition renders the substrate surface substantially planar upon chemical-mechanical polishing thereof.

34. The composition of claim 19, wherein said composition provides the substrate surface with a WWNU of less than about 12% upon chemical-mechanical polishing thereof.

35. The composition of claim 19, wherein said composition provides the substrate surface with a WTWNU of less than about 5% upon chemical-mechanical polishing thereof.

76. The composition of any one of claims 33, 34 and 35, wherein the feature comprises a material selected from a group consisting of Ir, IrO₂, Pt, and any combination thereof.

Document A

[illegible]

Document B

Slry name	Abrasive					NU% of cleared wfr
						(on TEOS plain)
ZCX206	CR30 (1 p), 2%					1.80%
ZCX206a	CR30 (1 p), 2%					1.69%
ZCX206a	CR30 (10 p), 2%					0.66%
ZCX206a	CR30 (10 p), 2%					1.22%